MANITOBA

Environmental Management Division
Environmental Control Services

Environmental Control Programs

File: 2483
Date: July 29, 1987

SOURCE TESTING FOR PARTICULATE EMISSIONS FROM THE PATHOLOGICAL INCINERATOR AT THE SEVEN OAKS GENERAL HOSPITAL WINNIPEG, MANITOBA 1986

Air Pollution Control
Environmental Control Services
Department of Environment
and Workplace Safety and Health

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ABSTRACT

After numerous reports of black smoke being emitted from the Seven Oaks General Hospital incinerator stack, the Air Pollution Control Section conducted a particulate source emission survey between April 22 and April 25, 1986.

During testing, the average particulate concentration was 0.409 grams per dry standard cubic meter at stack values of carbon dioxide (CO_2). When stack CO_2 concentration was corrected to 12%, the average particulate concentration increased to 0.751 grams per dry standard cubic meter calculated at standard* conditions.

This value exceeds Manitoba Incinerator Regulation, 334/74, Clause 3(1) (see Appendix 1). After incinerator and stack repairs or modifications have been completed a second emission survey will be required to demonstrate compliance.

* temperature 20°C, pressure 760 mm Hg

INTRODUCTION

A pathological incinerator was installed at the Seven Oaks General Hospital for the purpose of completely destroying Type I (general hospital rubbish) and Type IV (pathological waste). To determine general compliance with Manitoba Incinerator Regulation 334/74, Clause 3(1), the Air Pollution Control Section conducted three particulate tests between April 22 and April 25, 1986 on the exhaust stack while under normal operating conditions. Appendix 1 contains Manitoba Incinerator Regulation 334/74.

PROCESS DESCRIPTION

A Plibrico Model CABP 450 controlled air incinerator was tested for particulate emissions. Figure 1 depicts the incinerator as installed at the Seven Oaks General Hospital. The incinerator operates twice daily (12 hour cycle) on week days and once on the weekends to dispose of pathological and general hospital waste. The combined design capacity is 385 cubic feet of Type I (general hospital rubbish) and 100 pounds of Type IV waste (pathological) per 12 hour cycle.

The primary and after burner chambers were heated by natural gas burners. The maximum capacity of the ignition burner and reaction burner were 400,000 Btu/hr. and 1,500,000 Btu/hr. respectively. The incineration process was controlled automatically by a programmed timer which determined the sequence and duration of firing in the two chambers. Refer to Table 1 for burn cycle sequence during stack testing. Drying, ignition, and partial combustion of the waste occurred in the pathological and primary chambers. Air intake to the primary chambers was reduced to control the combustion rate and temperature. Final combustion of gasified and partially combusted volatile components occurred at the reaction burner (secondary chamber), where air was supplied in excess of stoichiometric requirements to ensure complete combustion.

The incinerator combustion products exit into a 117 foot divided stack which also serves the power boilers. The steel stack was designed with a 4 inch ceramic liner with a continuous interior

diameter of 45 inches. The 3 inch divider wall was located 19.5 inches from the incinerator side and 22.5 inches from the power boiler side.

At the end of the 12 hour cycle, the cooled ashes were removed from the primary and pathological chambers.

SEVEN OAKS GENERAL HOSPITAL

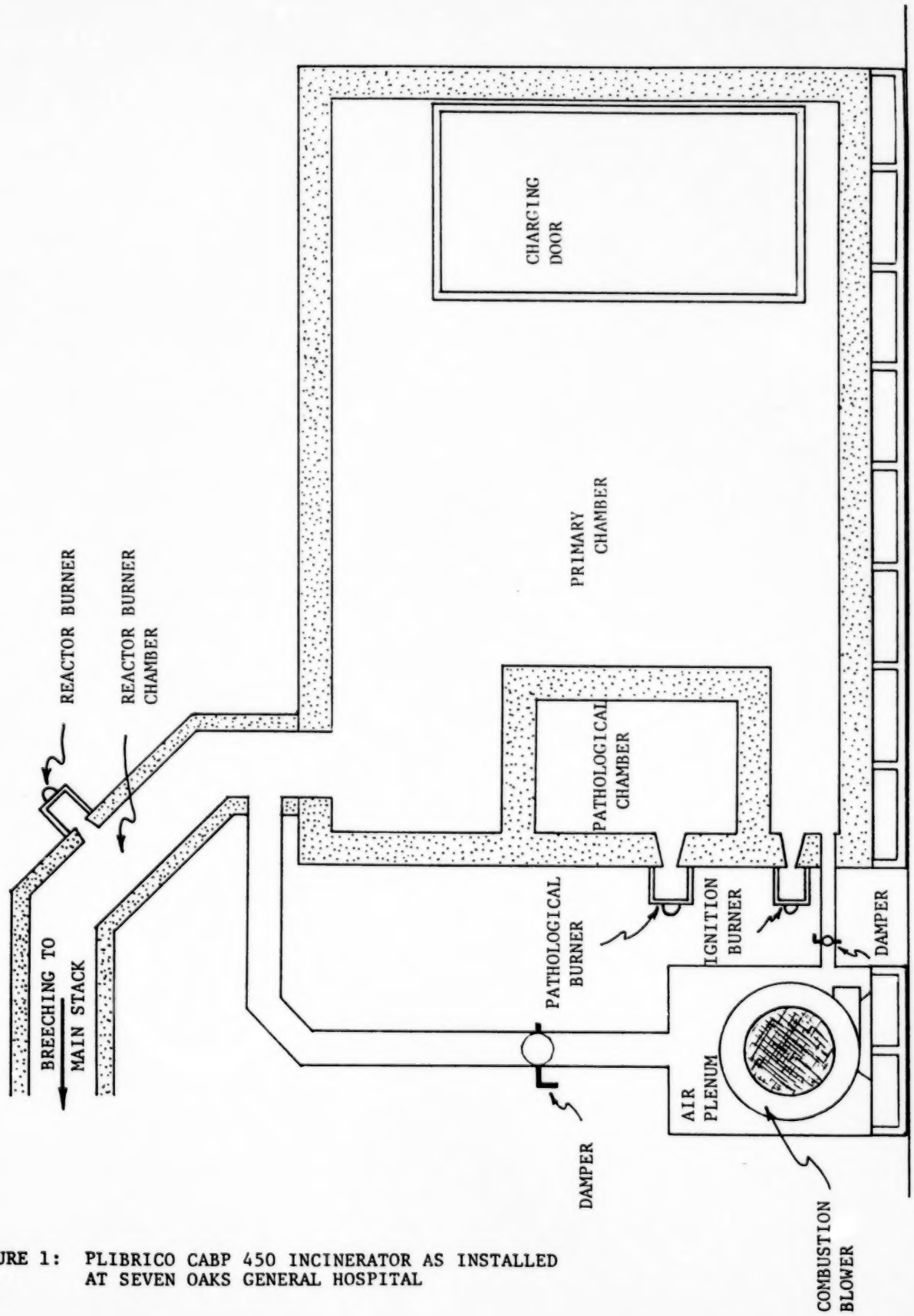


FIGURE 1: PLIBRICO CABP 450 INCINERATOR AS INSTALLED AT SEVEN OAKS GENERAL HOSPITAL

Table 1: INCINERATOR BURN CYCLE SEQUENCE

CONTROL	TIME (HOURS:MINUTES)
CYCLE INITIATION	0:00*
REACTOR BURNER ON	0:01
COMBUSIION BLOWER ON	0:30
IGNITION BURNER ON	0:31
IGNITION BURNER OFF	0:52
PATHOLOGICAL BURNER ON	0:55
PATHOLOGICAL BURNER OFF	2:55
REACTOR BURNER OFF	4:01
COMBUSTION BLOWER OFF	12:01

* Start time is expressed as 0:00 hours for convenience only

PROCESS SCHEDULE

Charging wastes for the 1986 particulate emission survey consisted of:

- general hospital rubbish packed in green garbage bags.
- pathological waste packed in orange garbage bags.
- special wastes such as plastic tubing and syringes, glass ampules and out of date drugs.

The incinerator was charged pursuant to incinerator design and operating instructions.

OFFICIAL TEST

The sampling facility consisted of a portable platform which permitted access to the northeast stack port and supported the sample probe and recovery train while sampling operations were in progress at roof level.

The height of the 45 inch inside diameter divided stack was approximately 55 feet from the breeching to the sampling ports which translates into 14.7 stack diameters of undisturbed flow. Two sample ports were installed on the divided stack but due to divider deterioration it was decided no greater accuracy could be achieved by sampling both ports. Figure 2 shows the location of the three sampling points and the two sampling ports. The northeast sample port was used for the three test survey. Sampling intervals were 5 minutes per point and each point was sampled twice.

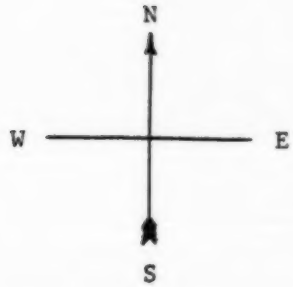
Particulate testing was conducted according to EPS method E, with sample probe modifications to compensate for the elevated stack temperature. Figure 3 depicts the sample collection system. The particulate was drawn into a stainless steel sample nozzle and through a water cooled stainless steel probe. Connected to the probe was a miniature cyclone and flask which collected particulate matter greater than 10 μ diameter. The sample was then passed through a Whatman 934 AH glass fiber filter supported by a porous fritted glass disc which removed particulates of 0.3 μ diameter and greater. Both the cyclone and the filter were heated to prevent moisture condensing on glassware in the hot box. The gas sample was then passed through four

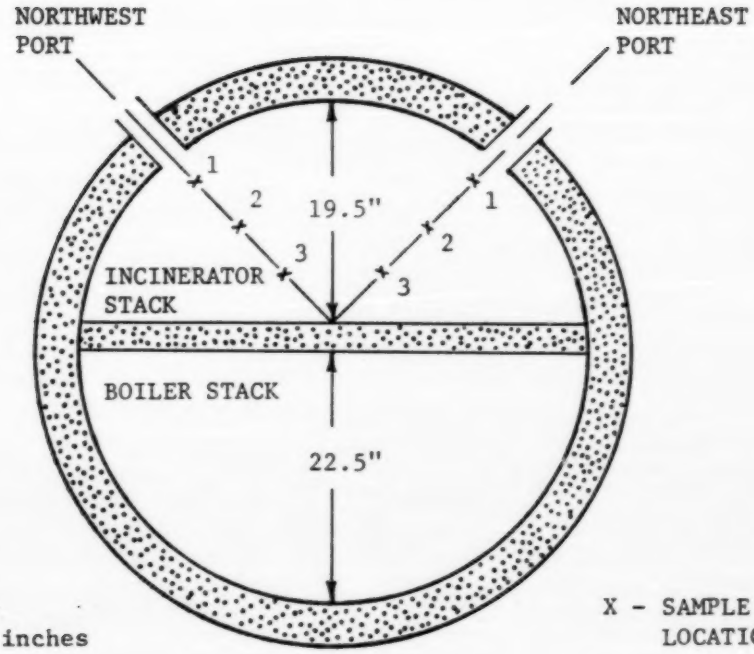
500 ml Greenburg-Smith impingers connected in series. The first, second and fourth impingers utilized modified straight tips while the second impinger was of Standard Greenburg-Smith design. The first and second impingers were both filled with 100 mls of deionized water. The third impinger was initially empty while the fourth was filled with 200 grams of indicating silica gel which removed remaining moisture from the gas sample. For each test the impingers were immersed in an ice bath to condense water contained in the stack gas sample.

A Bendix Series 4500 Isokinetic Stack Sampler was used to extract the sample from the stack. Gas velocity in the stack was measured with a S-type pitot tube and a Dwyer Magnehelic Differential Pressure gauge (range 0-0.25 inches water). Velocity profiles for all tests can be found in Appendix 2. Dry gas meter and pitot tube calibration sheets are presented in Appendix 3. A Hays-Republic Model 621A Gas Analyzer was used to determine CO_2 (carbon dioxide), O_2 (oxygen) and CO (carbon monoxide) content of the stack gas, while N_2 (nitrogen) was calculated by difference. Stack temperature was measured by a K type thermocouple.

After sample recovery from the stack train, samples were submitted to the W. M. Ward Technical Services Laboratory, 745 Logan Avenue, for gravimetric analysis of particulate.

SEVEN OAKS GENERAL HOSPITAL



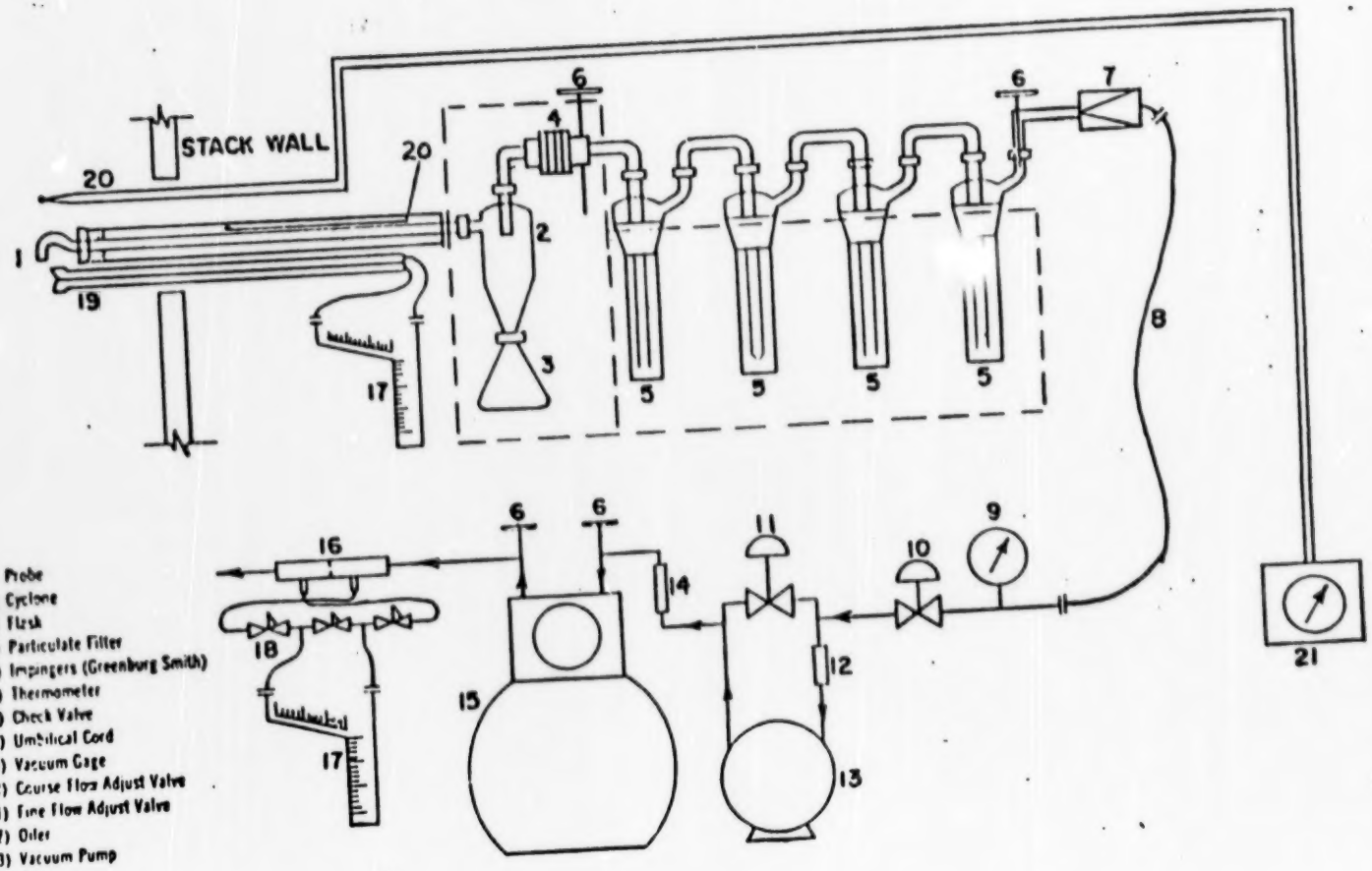


INSIDE STACK DIAMETER: 45 inches

X - SAMPLE POINT LOCATIONS

TRAVERSE POINT LOCATION FROM STACK WALL	
TRAVERSE POINT	DISTANCE inches
1	1.98
2	6.62
3	13.28

FIGURE 2: CROSS SECTION OF DIVIDED STACK



1) Probe
2) Cyclone
3) Flask
4) Particulate Filter
5) Impingers (Greenburg Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Pyrometer

FIGURE 3: PARTICULATE STACK SAMPLING TRAIN

RESULTS

The Seven Oaks General Hospital pathological incinerator was operated normally during particulate tests. Sampling parameters are summarized in Table 2. Appendix 4 contains field data sheets.

Particulate concentrations and emission rates are summarized in Table 3. Laboratory analytical reports are located in Appendix 5.

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TABLE 2: SUMMARY OF SAMPLING PARAMETERS FOR PARTICULATE TESTS

TEST NUMBER		1	2	3	AVERAGE
Sampling Date		APRIL 22, 1986	APRIL 23, 1986	APRIL 25, 1987	-
Sampling Time		12:04 P.M. 12:34 P.M.	11:00 A.M. 11:30 A.M.	10:30 A.M 11:00 A.M	-
Sampling Duration min		30	30	30	-
Average Stack Gas Temperature °F (°C)		1026 (552)	892 (478)	851 (455)	923 (495)
Ambient Temperature °F (°C)		51 (11)	66 (19)	46 (8)	54 (13)
Average Stack Gas Velocity ft/sec. (m/s)		21.2 (6.5)	18.6 (5.7)	21.1 (6.4)	20.3 (6.2)
Stack Gas Static Pressure inches H_2O (mmH_2O)		0.42 (10.7)	0.42 (10.7)	0.42 (10.7)	0.42 (10.7)
Stack Gas Moisture %		8.4	10.8	9.8	9.7
Stack Gas Composition % By Volume on a Dry Basis	N_2	81.7	82.7	82.2	82.2
	O_2	11.3	10.8	11.5	11.2
	CO_2	7.0	6.5	6.3	6.6
	CO	-	-	-	-
Sample Volume acf (acm)		16.908 (0.4788)	17.376 (0.4921)	19.136 (0.5419)	17.807 (0.5043)
Average Gas Meter Temperature °F (°C)		84 (29)	87 (31)	82 (28)	84 (29)
Average Orifice Pressure Drop inches H_2O (mmH_2O)		1.110 (28.2)	1.164 (29.6)	1.462 (37.1)	1.245 (31.6)
Average Isokinetic Factor %		99.4	108.4	100.3	102.7

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TABLE 3: PARTICULATE CONCENTRATIONS AND EMISSION RATES

TEST NUMBER	1	2	3	AVERAGE
Sampling Volume dscm	0.4713	0.4627	0.5207	0.4849
Total Particulate Catch mg	179.1	124.6	301.5	201.7
Average Stack Gas Volumetric Flow Rate dscm/hr	8,503	7,653	9,256	8,471
*Particulate Emission at Stack Values of CO_2 grams/dscm	0.380	0.269	0.579	0.409
Particulate Emission Corrected to 12% CO_2 grams/dscm	0.651	0.497	1.112	0.753
Particulate Emission Rate at Stack Value of CO_2 kg/hr	3.2	2.1	5.4	3.6

* Particulate emissions are calculated on a dry basis at standard conditions. That is, a temperature of 20°C centigrade (68° fahrenheit) and a pressure of 760 mm Hg (29.92 in. Hg) as stated in Section 1(j) of Manitoba Incinerator Regulation 334/74.

DISCUSSION OF RESULTS

The Seven Oaks General Hospital is equipped with a divided stack which serves the power boiler and the incinerator. An incinerator particulate emission survey was conducted through the northwest port. A preliminary velocity traverse indicated that no additional accuracy could be achieved by sampling through both ports due to the present condition of the stack. Stack diameter measurements revealed erosion of the ceramic stack liner increasing the inside stack diameter from 45 inches to 47 inches. At the time of the survey it was discovered the wall which separated the power boiler and the incinerator stack did not exist at various locations including the vicinity where sample ports were located. Therefore incinerator and power boiler exhaust gases were mixed as they travelled up the stack. This condition presented several problems. The incinerator exhaust was diluted by the boiler exhaust decreasing the percent carbon dioxide in the flue gas. Final combustion of the gasified and partially combusted volatile components occurred in the reaction burner chamber. The stack temperature was decreased when the two exhaust gases mixed, shorting the high temperature retention time created by the reaction burner, resulting in increased particulate emissions. Stack repairs will be required before additional testing can be carried out.

CONCLUSION

Tests 1 to 3 indicated an average particulate emission of 0.753 grams/dscm when corrected to 12% CO_2 (0.409 grams/dscm at average stack value of CO_2), which is in non-compliance with Manitoba Incinerator Regulation 334/74, Section 3(1) limit of 0.23 grams/dscm of flue gas corrected to 12% CO_2.

BIBLIOGRAPHY

1. Standard Reference Method For Source Testing: Measurements of Emissions of Particulates From Stationary Sources. Ottawa, Ontario: Environment Canada, Environmental Protection Service, 1974 (Report EPS 1-AP-74-1).

APPENDIX 1

MANITOBA REGULATION 334/74

Manitoba Regulation 334/74

Being a Regulation Under The Clean Environment Act
Respecting Incinerators

(Filed December 31, 1974)

1 In this Regulation,

(a) "domestic incinerator" means an incinerator used for a single family residence or for a two-family residence, either in duplex or double house form, or for multiple-dwelling units in which such incinerator serves fewer than three apartments;

(b) "existing incinerator" means an incinerator placed in operation before the effective date of this Regulation;

(c) "flue'fed incinerator" means an incinerator provided with a flue which serves as a charging chute in addition to conducting the products of combustion to the atmosphere;

(d) "incinerator" means a device used for the process of burning waste and from which the products of combustion are conveyed to the atmosphere by passage through a stack;

(e) "new incinerator" means an incinerator placed in operation after the effective date of this Regulation;

(f) "opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background;

(g) "particulates" means any material, except uncombined water, which exists in a finely divided form as a liquid or solid at standard conditions;

(h) "Ringelmann Number" means a value on the Ringelmann Smoke Chart for grading the density of smoke published by the U.S. Bureau of Mines, or any other chart, recorder, indicator or device for the measurement of smoke density which is approved by the Department as the equivalent of the said Ringelmann Smoke Chart;

(i) "smoke" means small gas-borne particles resulting from combustion, consisting predominantly but not exclusively of carbon and ash, which form a visible plume under draft;

(j) "standard condition" means a temperature of 20° Centigrade (68° Fahrenheit) and a pressure of 760 mm Hg (29.92 in. Hg);

(k) "standard cubic foot" means the volume of one cubic foot of gas at standard conditions;

(l) "standard cubic metre" means the volume of one cubic metre of gas at standard conditions.

2(1) A person intending to construct or set into operation a new incinerator is not required to file a proposal with the Department as provided in Section 14(1) of The Clean Environment Act.

2(2) Prior to operating a new incinerator a person shall register the incinerator with the Department on a form approved by the Department.

3(1) No person shall operate any new incinerator which emits more than 0.23 grams of particulates per standard cubic metre (0.10 grains per standard cubic foot) of dry flue gas corrected to 12 percent carbon dioxide by volume.

3(2) No person shall operate a new incinerator which emits smoke the opacity of which is equal to or greater than

(a) 40 percent (equivalent to number 2 on the Ringelmann Smoke Chart) at any time; or

(b) 20 percent (equivalent to number 1 on the Ringelmann Smoke Chart) for a period exceeding 4 minutes in any one hour.

4(1) No person shall construct or install any domestic incinerator after the effective date of this Regulation.

4(2) No person shall construct or install any flue-fed incinerator after the effective date of this Regulation.

5(1) The rated capacity and the type of waste material for which the incinerator is designed shall be displayed in a conspicuous location near the incinerator.

5(2) Detailed instructions for the operation of the incinerator shall be posted in a conspicuous location near the incinerator.

5(3) Sampling ports shall be suitably located in the stack or breeching of new incinerators.

6 The method for measurement of particulates and opacity of smoke from incinerators shall be as approved by the Department.

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APPENDIX 2

VELOCITY PROFILES

TEST NO. 1

NORTH EAST PORT

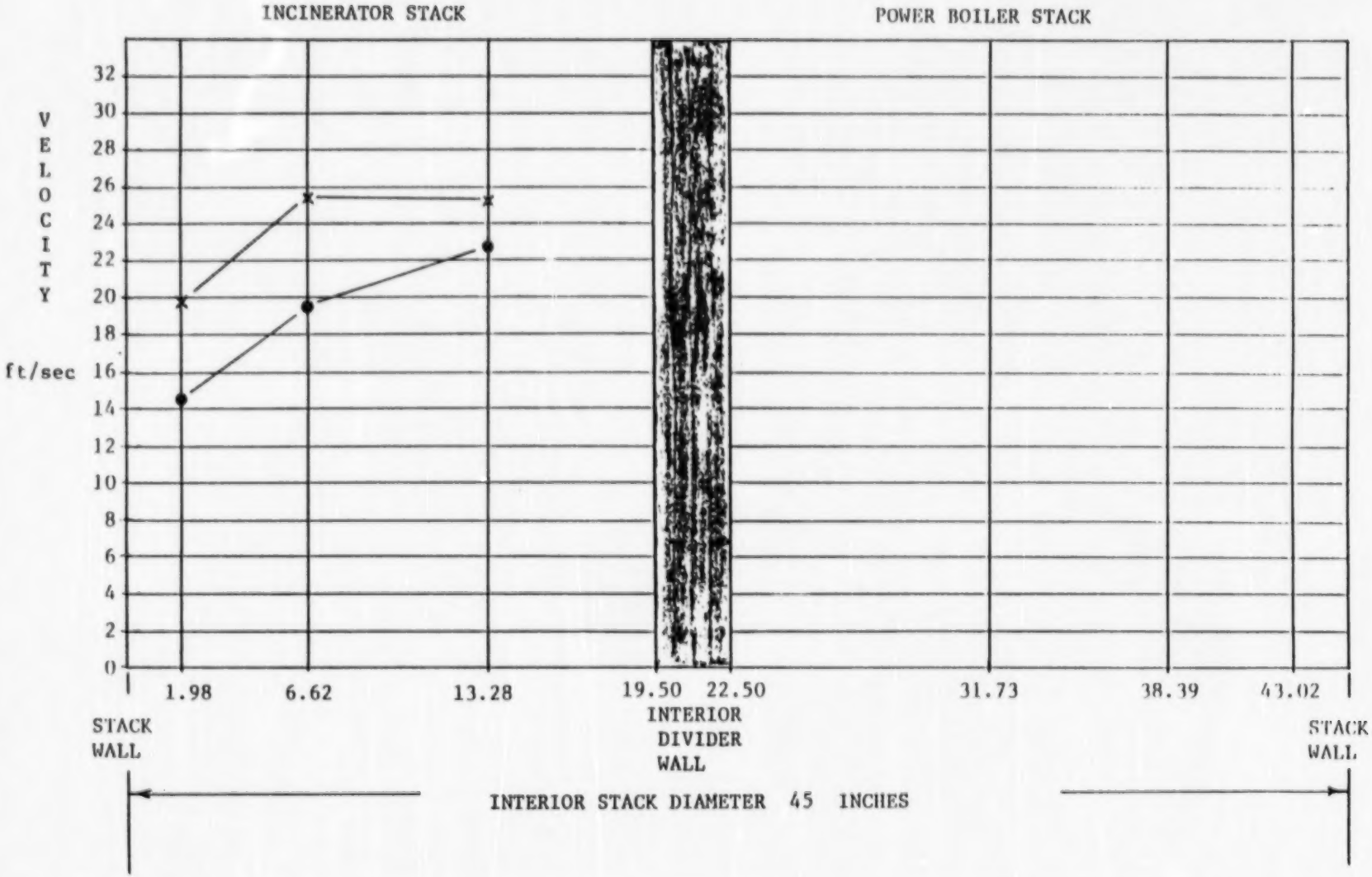
FIRST PASS x

SECOND PASS ●

COMBINED STACK

WIND SPEED 50 mph

DIRECTION SOUTH



SEVEN OAKS GENERAL HOSPITAL

INCINERATOR STACK VELOCITY PROFILE

TEST NO. 2

NORTH EAST PORT

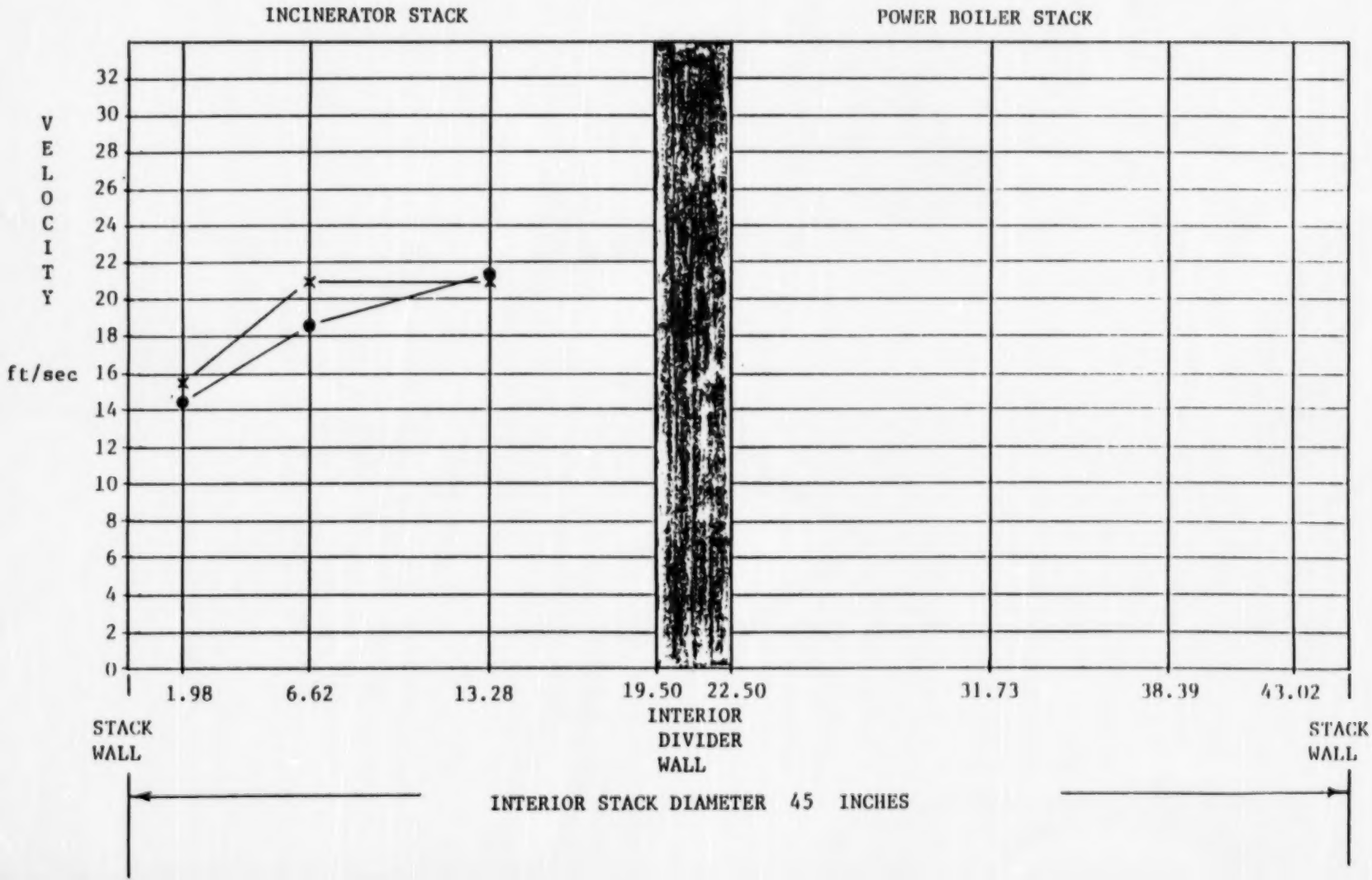
FIRST PASS x

SECOND PASS ●

COMBINED STACK

WIND SPEED 40 mph

DIRECTION SOUTH



SEVEN OAKS GENERAL HOSPITAL

INCINERATOR STACK VELOCITY PROFILE

TEST NO. 3

NORTH EAST PORT

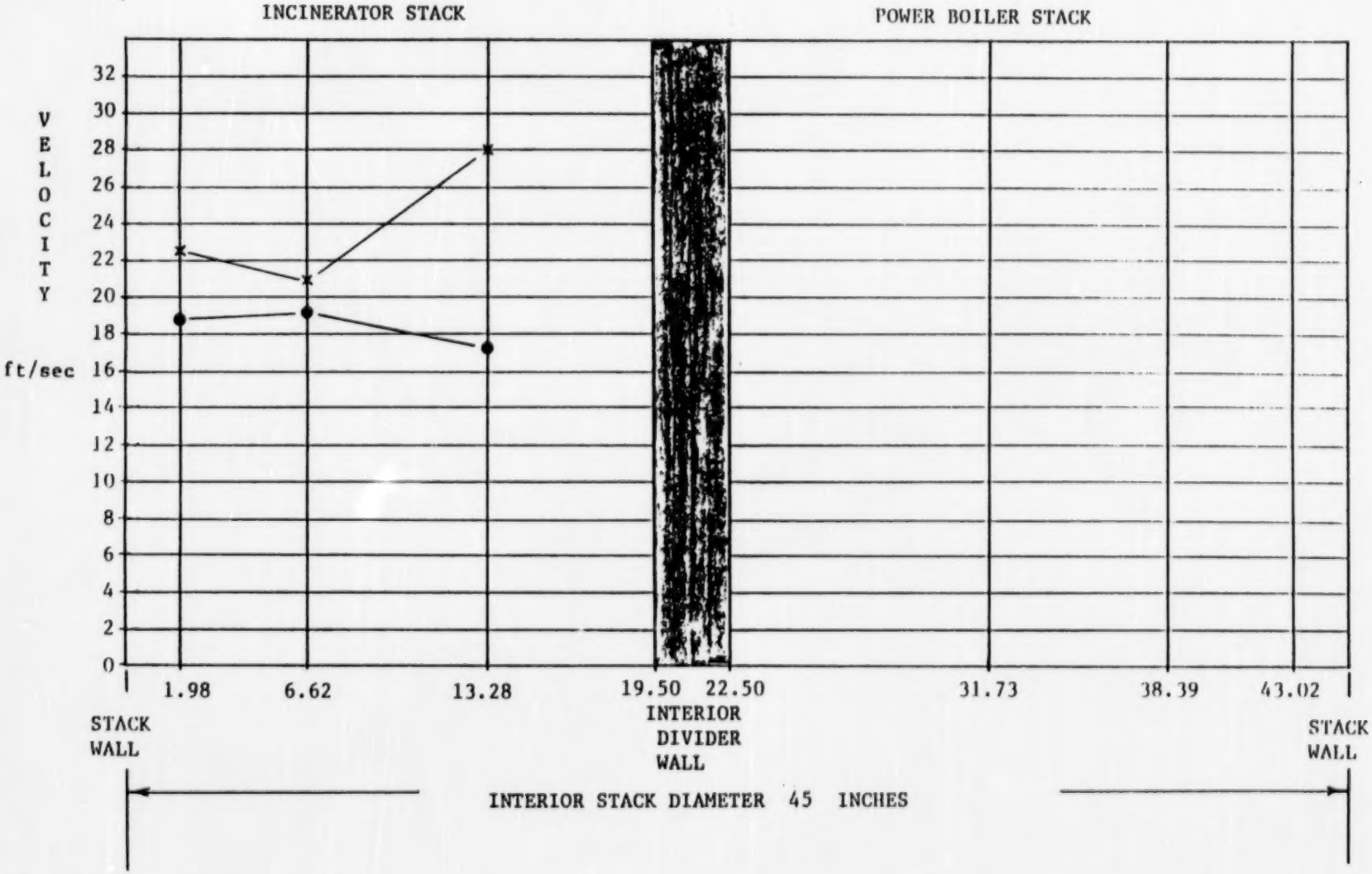
FIRST PASS x

SECOND PASS ●

COMBINED STACK

WIND SPEED 30 mph

DIRECTION SOUTH EAST



APPENDIX 3

EQUIPMENT CALIBRATION DATA

S-TYPE PITOT TUBE CALIBRATION

PROBE SIZE (ft) 5

CALIBRATION # 86-24

PROBE LINER S.S. WATER COOLED

DATE APRIL 10, 1986

PROBE MANUFACTURER ——

BAROMETRIC PRESSURE (Hg) 29.06

TIP SIZE (inches) 0.500

AMBIENT TEMP. (°C) 22.4

TIP TYPE S.S

OPERATOR KR. + A.S.

STACK THERMOCOUPLE ☒ PRESENT

☐ ABSENT

HP 97 INPUT/OUTPUT

Temp	22.4	°C
Bar. Press	29.06	In. Hg
Scale Factor	0.1	

1.	0.10	Δ p (std)
Tunnel Velocity	6.77519	ft/sec
	0.16	Δ p (s-pitot)
Cp, at this	0.788593	velocity
Tunnel Velocity	6.776579	(using Cp)

2.	0.20	Δ p (std)
	9.581522	
	0.31	Δ p (s-pitot)
	0.801211	
	9.583530	

3.	0.32	Δ p (std)
	12.119773	
	0.53	Δ p (s-pitot)
	0.775086	
	12.122313	

4.	0.46	Δ p (std)
	14.531098	
	0.72	Δ p (s-pitot)
	0.797307	
	14.534143	

5.	0.62	Δ p (std)
	16.870010	
	1.00	Δ p (s-pitot)
	0.785432	
	16.873546	

6.	0.80	Δ p (std)
	19.163044	
	1.25	Δ p (s-pitot)
	0.798000	
	19.167060	

7.	1.12	Δ p (std)
	22.674019	
	1.78	Δ p (s-pitot)
	0.791247	
	22.678771	

8.	1.32	Δ p (std)
	24.615376	
	2.12	Δp(s-pitot)
	0.787104	
	24.620534	

9.	1.85	Δ p (std)
	29.141061	
	2.94	Δp(s-pitot)
	0.791271	
	29.147169	

0.790583	Cp (ave)
0.007881	Std. Dev.
8	Deg. of Freedom

2.306	t .05
0.784526	Low Cp
0.790583	Mean Cp
0.796641	High Cp

rev. 82-01

DRY GAS METER & ORIFICE METER CALIBRATION SHEET

Lab No. 5668 ½

Dry Gas Meter S/N Bendix 711030

Atmospheric Pressure 29.13 in. Hg / 740.0 mm Hg

Ambient Temperature 23.0 °C

Calibrated re Large Wet Test Meter

Calibrated by Jim Prokopowich & Kevin Reeve

Date 11 April 86

Manometer Orifice ΔH (in. H_2O)	W.T.M. Volume Vw (Ft.^{3})	Dry Gas Meter Reading Initial (Ft.^{3})	Dry Gas Meter Reading Final (Ft.^{3})	D.G.M. Volume Vd (Ft.^{3})	Temperature W.T.M. Tw (°F.)	Temperature W.T.M. Tw (°C.)	Temperature D.G.M. Ti (°F.)	Temperature D.G.M. To (°F.)	Time t (Min.:Sec.)	Time t (Min.)	W.T.M. Manometer Δm (in. H_2O)	Partial Pressure Ps (mm. Hg)	W.T.M.:D.G.M. Ratio γ (—)	$\sqrt{\ }$ (—)	Flowrate @ S.T.P. Qm (Ft.^{3}/min.)
0.500	4.0	278.900	282.958	4.058	64.5	18.1	106	85	10:29.30	10.4883	0.30	15.575	1.0199	0.5681	0.3872
0.500	4.0	283.969	288.032	4.064	64.8	18.2	106	85	10:30.43	10.5072	0.27	15.673	1.0178	0.5681	0.3862
0.500	4.0	289.049	293.126	4.077	65.0	18.3	106	86	10:31.48	10.5247	0.28	15.772	1.0149	0.5686	0.3861
1.03	4.0	296.190	300.288	4.098	65.1	18.4	112	86	7:19.77	7.3295	0.34	15.871	1.0133	0.8156	0.5534
1.03	4.0	302.338	306.451	4.113	65.2	18.4	112	87	7:20.11	7.3352	0.35	15.871	1.0103	0.8163	0.5538
1.03	4.0	307.472	311.587	4.115	65.3	18.5	112	87	7:20.20	7.3367	0.46	15.971	1.0092	0.8163	0.5534
1.52	5.0	314.671	319.820	5.233	65.5	18.6	113	87	7:27.89	7.4648	0.53	16.071	0.9910	0.9910	0.6786
1.53	5.0	320.842	325.994	5.174	65.5	18.6	113	88	7:28.09	7.4682	0.56	16.071	1.0031	0.9952	0.6794
1.53	5.0	327.022	332.169	5.147	65.5	18.6	114	88	7:28.15	7.4692	0.51	16.071	1.0093	0.9952	0.6794
2.05	6.0	334.225	340.406	6.237	65.6	18.7	115	88	7:48.98	7.8163	0.59	16.172	0.9986	1.1512	0.7777
2.05	6.0	341.439	347.625	6.186	65.7	18.7	115	88	7:49.02	7.8170	0.47	16.172	1.0069	1.1512	0.7777
2.05	6.0	348.652	354.837	6.185	65.7	18.7	115	88	7:49.02	7.8170	0.47	16.172	1.0071	1.1512	0.7777

Linear Regression: Intercept (b) 0.0086

Slope (%) 0.6659

Coefficient of Determination (r^2) 0.9995

$\bar{\gamma}$ = 1.0094 ± 0.0068

ΔHg = 2.0725

Comments:

#245 Rev. 9/29/85 JF/cm

DRY GAS METER & ORIFICE METER CALIBRATION SHEET

Lab No. 5668 2/2

Dry Gas Meter S/N: Bendix 711030

Atmospheric Pressure: 29.13 in. Hg / 740.0 mm Hg

Ambient Temperature: 23.0 °C

Calibrated re: Large Wet Test Meter

Calibrated by: Sam Prokopovich & Kevin Reese

Date: 11 April 86

Manometer Orifice ΔH (in. H_2O)	W.T.M. Volume Vw (Ft.^{3})	Dry Gas Meter Reading Initial (Ft.^{3})	Dry Gas Meter Reading Final (Ft.^{3})	D.G.M. Volume Vd (Ft.^{3})	Temperature W.T.M. Tw (°F.)	Temperature W.T.M. Tw (°C.)	Temperature D.G.M. Ti (°F.)	Temperature D.G.M. To (°F.)	Time t (Min.:Sec.)	Time t (Min.)	W.T.M. Manometer Δn (in. H_2O)	Partial Pressure Ps (mm. Hg)	W.T.M.:D.G.M. Ratio γ (—)	$\sqrt{\ }$ (—)	Flowrate @ S.T.P. Qm (Ft.^{3}/min.)
3.06	6.0	366.164	372.334	6.177	66.0	18.9	116	89	6:23.26	6.4710	0.72	16.375	1.0062	1.4060	0.9374
3.05	6.0	373.377	379.547	6.170	66.0	18.9	116	89	6:23.24	6.4707	0.77	16.375	1.0072	1.4037	0.9373
3.04	6.0	380.582	386.752	6.170	66.0	18.9	117	89	6:23.27	6.4712	0.71	16.375	1.0083	1.4014	0.9374
2.54	6.0	388.811	394.992	6.181	66.0	18.9	116	89	7:03.38	7.0563	0.50	16.375	1.0074	1.2818	0.8612
2.54	6.0	396.022	402.200	6.178	66.1	18.9	116	89	7:03.37	7.0562	0.57	16.375	1.0075	1.2819	0.8609
2.53	1.0	404.261	410.438	6.177	66.1	18.9	116	89	7:03.40	7.0567	0.51	16.375	1.0078	1.2793	0.8610
0.497	4.0	412.485	416.593	4.105	66.5	19.2	118	88	10:46.74	10.6790	0.31	16.685	1.0114	0.5679	0.3803
0.491	4.0	417.621	421.718	4.097	66.5	19.2	118	87	10:40.63	10.6772	0.45	16.685	1.0171	0.5640	0.3795
0.491	4.0	422.745	426.838	4.093	66.7	19.3	117	87	10:46.67	10.6778	0.33	16.790	1.0170	0.5640	0.3794

Linear Regression: Intercept (b) 0.0036

Slope (K) 0.6659

Coefficient of Determination (r^2) 0.9995

$\overline{\gamma}$ = 1.0094 ± 0.0063

ΔH@ =

Comments:

#245 Rev. 9/25/85 JF/cm

APPENDIX 4

FIELD DATA SHEETS

FIELD DATA SHEET

Plant SEVEN OAKS GENERAL HOSPITAL Location 2300 McPhilips Street, Winnipeg

Stack INCINERATOR STACK Test number 1 Date April 22, 1986

Ambient temperature (°F) 51 Barometric pressure (in. Hg) 29.87 Time 12:04 P.M. - 12:34 P.M.

Nozzle diameter (in.) 0.498 Probe length/type 5 Foot/Stainless Steel Water Cooled Stack static pressure (in. H_2O) 0.42

Probe temperature (°F) - Filter holder temperature (°F) 240 Leak check 0.001 CFM @ 15 " Hg Vacuum

Traverse point number	Clock time	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F Inlet	Gas meter temperature, °F Outlet	Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
NORTH EAST PORT										
1	5	1035	2.649	0.050	0.975	76	72	55	5	101.1
2	10	1131	3.157	0.076	1.390	89	73	56	6	99.7
3	15	1138	3.148	0.075	1.360	96	74	56	6	99.5
3	20	1044	3.034	0.064	1.240	100	74	56	6	100.6
2	25	967	2.722	0.050	1.020	102	75	57	5	98.8
1	30	838	2.198	0.031	0.682	102	76	55	5	96.9
Average or total	30	1026	16.908	0.058	1.110	94	74	56	6	99.4

FIELD DATA SHEET

Plant SEVEN OAKS GENERAL HOSPITAL Location 2300 McPhilips Street, Winnipeg

Stack INCINERATOR STACK Test number 2 Date April 23, 1986

Ambient temperature (°F) 66 Barometric pressure (in. Hg) 28.63 Time 11:00 A.M. - 11:30 A.M.

Nozzle diameter (in.) 0.498 Probe length/type 5 Foot/Stainless Steel Water Cooled Stack static pressure (in. H_2O) 0.42

Probe temperature (°F) - Filter holder temperature (°F) 290 Leak check 0.000 CFM @ 15 " Hg Vacuum

Traverse point number	Clock time	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F Inlet	Gas meter temperature, °F Outlet	Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
NORTH EAST PORT										
1	5	846	2.547	0.034	0.896	81	74	48	4	108.8
2	10	922	3.126	0.055	1.380	94	74	46	5	107.4
3	15	926	3.174	0.056	1.400	98	74	49	6	107.9
3	20	925	3.236	0.057	1.420	103	75	50	6	108.3
2	25	898	2.945	0.045	1.140	105	76	51	5	109.8
1	30	836	2.348	0.028	0.746	104	76	54	4	108.2
Average or total	30	892	17.376	0.046	1.164	98	75	50	5	108.4

FIELD DATA SHEET

Plant SEVEN OAKS GENERAL HOSPITAL Location 2300 McPhilips Street, Winnipeg

Stack INCINERATOR STACK Test number 3 Date April 25, 1986

Ambient temperature (°F) 46 Barometric pressure (in. Hg) 29.27 Time 10:30 A.M. - 11:00 A.M.

Nozzle diameter (in.) 0.498 Probe length/type 5 Foot/Stainless Steel Water Cooled Stack static pressure (in. H_2O) 0.42

Probe temperature (°F) - Filter holder temperature (°F) 265 Leak check 0.000 CFM @ 15 " Hg Vacuum

Traverse point number	Clock time	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F Inlet	Gas meter temperature, °F Outlet	Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
NORTH EAST PORT										
1	5	810	3.416	0.071	1.670	72	69	40	7	100.2
2	10	936	2.975	0.057	1.230	88	70	42	12	101.0
3	15	860	4.177	0.108	2.505	92	71	43	12	99.9
3	20	919	2.509	0.039	0.855	97	72	44	5	101.1
2	25	852	2.868	0.050	1.100	100	73	43	5	99.2
1	30	727	3.191	0.055	1.410	102	76	44	6	100.1
Average or total	30	851	19.136	0.063	1.462	92	72	43	8	100.3

APPENDIX 5

LABORATORY ANALYSIS DATA

W.M. WARD TECHNICAL SERVICES LABORATORY CHEMICAL ANALYSIS FORM II

SUBMITTER KEVIN REEVE
LOCATION SEVEN OAKS HOSPITAL – TEST #1
REPORT TO KEVIN REEVE – AIR POLLUTION CONTROL ER-1

SAMPLE ID From Y 86 Sequent 06915 To Y 86 Sequent 06917

Date Sampled Y 86 M 04 D 22 Date Received Y 86 M 04 D 28

L – Less than
G – Greater than

Sample Number	Identification or Comments	Parameter	L/G	Value	Units	Date Analyzed
6915	Bottle #2 - Probe washings + glassware before filter	T.S.P.		0.0002	g	05 [illegible]
6916	Bottle #1 - Impinger 1 and 2 contents	T.S.P.		0.1380	g	05 [illegible]
6917	filter #493	T.S.P.		0.0409	g	04 [illegible]

Chemist Signature [illegible] Date [illegible]

MG 2[illegible] 2 SM

W.M. WARD TECHNICAL SERVICES LABORATORY CHEMICAL ANALYSIS FORM II

SUBMITTER K. REEVE
LOCATION SEVEN OAKS HOSPITAL - Test #2
REPORT TO K. REEVE - AIR POLLUTION CONTROL
ER-1

SAMPLE TO

From Y	From Sequent	To Y	To Sequent
86	06918	86	06920

L – Less than
G – Greater than

Date Sampled Y	M	D	Date Received Y	M	D
86	04	23	86	04	28

Sample Number	Identification or Comments	Parameter	L/G	Value	Units	Date Analyzed
6918	bottle #1 - Probe washings and glassware before filter	T.S.P.		0.1020	g	0503
6919	bottle #2 - Impinger 1 and 2 contents	T.S.P.		0.0022	g	0502
6920	filter # 494	T.S.P.		0.0204	g	0430

Chemist Signature [signature]
Date [illegible]

W.M. WARD TECHNICAL SERVICES LABORATORY CHEMICAL ANALYSIS FORM II

SUBMITTER K. REEVE
LOCATION SEVEN OAKS HOSPITAL - TEST #3
REPORT TO K. REEVE - AIR POLLUTION CONTROL ER-1

SAMPLE ID From: Y 86 Sequent 06921 To: Y 86 Sequent 06923

Date Sampled: Y 86 M 04 D 25

Date Received: Y 86 M 04 D 28

L - Less than
G - Greater than

Sample Number	Identification or Comments	Parameter	L/G	Value	Units	Date Analyzed
6921	bottle #1 - Probe washings and glass ware before filter	T.S.P		0.2698	g	0502
6922	bottle #2 - Impinger 1 and 2 contents	T.S.P		0.0020	g	0502
6923	filter # 495	T.S.P.		0.0297	g	0420

Chemist Signature [signature] Date [illegible]